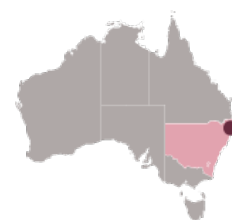


# New Dungowan Dam and Pipeline



**PURPOSE OF EVALUATION**  
Proposal seeking funding



**EVALUATION OUTCOME**  
Not recommended for the  
Infrastructure Priority List at this  
time

## ASSESSMENT FRAMEWORK STAGE



### LOCATION

Tamworth, New South Wales

### GEOGRAPHY

Smaller cities and regional centres

### SECTOR

Water

### OUTCOME CATEGORY

Resilience

### PROPONENT

NSW Government

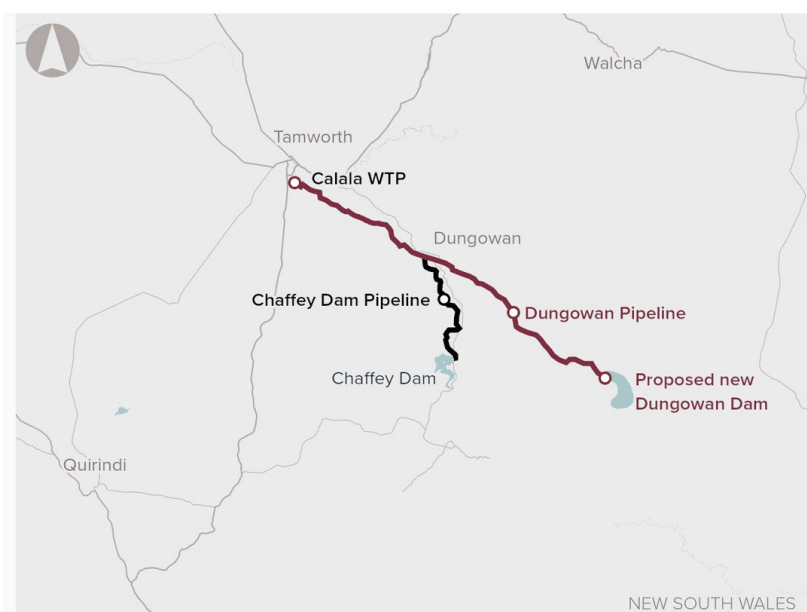
### INDICATIVE DELIVERY TIMEFRAME

Construction start: 2023

Completion by: 2029

### EVALUATION DATE

5 July 2022

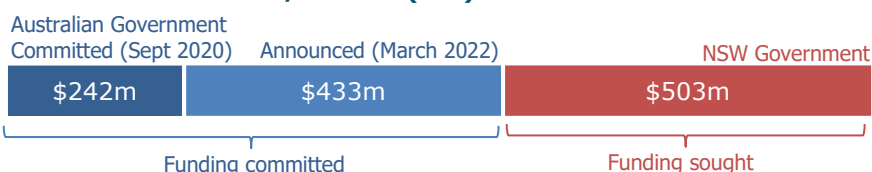


### CAPITAL COST

\$1,034.3 million (P50, outturn)

\$1,178.6 million (P90, outturn)

### FUNDING COMMITTED/SOUGHT (P90)<sup>1</sup>



## Review summary

Infrastructure Australia has evaluated the business case for the **New Dungowan Dam and Pipeline** in accordance with our Statement of Expectations, which requires us to evaluate proposals that are nationally significant or where Australian Government funding of \$250 million or more is sought. As a result of our assessment, the proposal has not been added to the *Infrastructure Priority List* at this time.

The New Dungowan Dam and Pipeline aims to increase town water supply for Tamworth and maintain water reliability for agricultural production in the Peel Valley. The proposal was developed in response to long periods of drought,

<sup>1</sup> The 2022-2023 budget included an additional \$433 million toward construction of Dungowan Dam, pending finalisation of the business case

water restrictions and, in 2019, Tamworth being 12 months away from running out of water from its primary water source, the Chaffey Dam. The proposed New Dungowan Dam would underpin water security for Tamworth and reduce the risk of shortfalls, while maintaining water for agricultural users.

While the New Dungowan Dam and Pipeline will have community benefit and increase resilience, it is a significant infrastructure intervention with costs that far outweigh the benefits that will be delivered. Based on our assessment, the Increased Urban Reserve option (Chaffey Dam)<sup>2</sup>, which is also considered in the business case, appears to be a feasible, lower cost solution that addresses the problem and warrants further detailed consideration.

The options analysis detailed in the business case did not sufficiently consider the extent to which the service need (which is to address the region's water security risk) could be addressed through non-infrastructure solutions. In our view, an inappropriate weighting was placed on the need for shortlisted options to augment the water storage capacity of the region, which resulted in the Dungowan Dam being identified as the recommended response. It is likely the service need (to improve the water supply-demand balance and in doing so reduce the magnitude of the water security risk) could be efficiently addressed through more conservative infrastructure solutions or a package of infrastructure and non-infrastructure measures. This is demonstrated by the results of the cost-benefit analysis, with the New Dungowan Dam and Pipeline returning a Net Present Value (NPV) of -\$525.1 million and Benefit Cost Ratio (BCR) of 0.09. This compares with the Increased Urban Reserve option, which returned a NPV of -\$3.3 million and BCR of 0.49.

The draft Namoi Regional Water Strategy<sup>3</sup> includes a longlist of 56 infrastructure and non-infrastructure options to address a diverse range of challenges and opportunities for water management in the Namoi. The non-infrastructure solutions, including demand management and water use efficiency measures, combined with more targeted, small scale supply solutions, such as recycled wastewater for industrial users, could be a more efficient means of addressing the service need. Infrastructure Australia recommends further analysis is undertaken on combinations of infrastructure and non-infrastructure options.

The economic analysis is robust and includes quantification of the economic benefit attributable to the avoided cost of water restrictions and the risk of water supply shortfalls. This shows that the economic benefits of the proposal are very low. While the business case includes qualitative information, including case studies, on the extent to which the water security risk is a constraint on potential future investment and economic activity in the region, the potential benefits of addressing this constraint have not been able to be determined. However, based on the evidence provided, quantifying these benefits is unlikely to have a materially significant impact on the BCR.

Based on our review of the evidence presented, a combination of non-infrastructure options and the Increased Urban Reserve option, including buying back water licenses from impacted irrigation water users, may present a stronger case for public investment. We would welcome a revised business case that recommends a lower cost response which better aligns to the identified problems and opportunities for providing increased water security to the Tamworth region. Lower cost solutions could be analysed and implemented before construction of the New Dungowan Dam and Pipeline is completed.

## Proposal description

The New Dungowan Dam and Pipeline proposal involves the partial decommissioning of the existing Dungowan Dam and construction of a new 22.5 GL dam, approximately three kilometres downstream from the existing dam site, along with the replacement and upsizing of the existing Dungowan Pipeline. The new pipeline would provide a maximum supply capacity of 71 ML per day to Tamworth, a more than three-fold increase from the current 22 ML per day pipeline.

## Review themes

Strategic Fit	The case for action, contribution to the achievement of stated goals, and fit with the community.
Case for change	The business case contains an extensive and robust assessment of the service need in relation to the urban water supply-demand balance in the region. The expected incidence of moderate and severe water restrictions has been identified, as has the risk of a water supply shortfall.

<sup>2</sup> Defined as an increase to the reserve in Chaffey for urban purposes (e.g. from 14GL to 35GL) to set aside more water for Tamworth. By increasing reserves, more water is set aside for Tamworth town water purposes and General Security allocations and releases are reduced.

<sup>3</sup> <https://www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/upcoming-public-exhibition/namoi-regional-water-strategy#:~:text=The%20Draft%20Namoi%20Regional%20Water%20Strategy%20is%20one%20of%2013,and%20other%20stakeholders%20across%20NSW.>

However, the qualitative description of the service need, in particular the adverse consequences of the lack of water on investment and economic activity, is not supported by quantitative evidence to support the case for change and for significant public investment.

<b>Alignment</b>	<p>The proposal aligns with the NSW Government's key policies and strategies, including:</p> <ul style="list-style-type: none"> <li>• The NSW Water Strategy and the Draft Namoi Regional Water Strategy</li> <li>• The NSW State Infrastructure Strategy 2018-38 and NSW Government Action Plan, and water security such as the National Water Grid Fund.</li> </ul>
<b>Network and system integration</b>	<p>The proposal's interdependencies with other regional projects, such as planned investments by major agricultural processors, as well as integration with other assets and services (during both construction and operational phases), the local water supply system and transport network, are appropriately identified. Potential disruptions and proposed actions for mitigation are set out in the business case to manage the occurrence of any risks.</p>
<b>Solution justification</b>	<p>A long list of 56 options, including non-infrastructure options, from the draft Namoi Regional Water Strategy were considered, and 6 of these were identified as addressing the service need and progressed for more detailed assessment. However, it appears that options were progressed primarily on their ability to increase the storage capacity of the region, whereas the service need is primarily to reduce water security risk. This is an important distinction as non-infrastructure solutions may reduce water security risk without increasing storage capacity. Non-infrastructure measures such as water pricing reform, water use efficiency and demand management measures were included in the draft Namoi Regional Water Strategy. In our view, the benefits of a package of these measures could significantly exceed the costs of the problem and provide a more efficient means of addressing the service need.</p> <p>The three shortlisted options considered in the Business Case are: 1) New Dungowan Dam and Pipeline; 2) New pipeline between Keepit Dam and Tamworth; and 3) Increased Urban Reserve to Chaffey Dam. The New Dungowan Dam and Pipeline option was selected based primarily on the results of a strategic merit assessment. The Increased Urban Reserve option scored relatively poorly on the 'investment decision readiness' criterion, however this option does not involve the construction of new infrastructure and the business case states the modelling and analysis required for implementation can be completed within 19 months. In our view, the conclusion reached in the strategic assessment is not consistent with the quantification of economic benefits and costs, or the underlying risks of the assessed options, and the Increased Urban Reserve option appears to have been underscored in the strategic merit test.</p>
<b>Stakeholder endorsement</b>	<p>While many stakeholders appear to be broadly supportive of the proposal, concerns have been raised by some First Nations, community and environmental groups. An Environmental Impact Statement (EIS) for Dungowan Dam and Stage 2 Pipeline, and Aboriginal Engagement and Participation Plan, are in development to address stakeholders' key concerns. A Review of Environmental Factors (REF) for the Stage 1 Pipeline was in development at the time the business case was submitted to Infrastructure Australia and is now complete.</p>
<b>Societal Impact</b>	<p><b>The social, economic and environmental value of the proposal, as demonstrated by evidence-based analysis.</b></p>
<b>Quality of life</b>	<p>The proposal results in a material reduction in the incidence of moderate and severe water restrictions and the risk of a water supply shortfall. Although the proposal addresses the service need and will have a positive impact on quality of life for the regional community, these same outcomes could be achieved through lower cost solutions that minimise the burden on taxpayers.</p> <p>The business case does not indicate if the proposal's construction costs will be recovered through water bills. However, scenario analysis considered options including no recovery of construction costs and a scenario where 10% of construction costs are recovered. While operating and maintenance costs will need to be recovered from water users either directly or indirectly, the business case reports a modest impact on customer bills.</p>

<b>Productivity</b>	<p>The proposal will improve the region's water security outlook, potentially alleviating constraints on future business investment and economic activity in the region, although this was not able to be quantified in the economic appraisal. It is therefore not possible to assess whether the impact of the proposal on the productivity of the region will be material, noting that the quantified economic benefits from the reduced incidence of water restrictions and risk of a water supply shortfall are relatively small.</p> <p>The new dam will not result in any increased allocation or entitlements for irrigators in the Peel valley.</p>
<b>Environment</b>	<p>Biodiversity offset costs have been robustly estimated and categorised as a component of capital expenditure. This is an estimate of the likely offsetting costs required under State and Federal legislation. The business case states that 13 of the 22 EIS reports have been completed, with the remaining studies identified as being of low or medium complexity. EIS processes often identify material issues for bulk water infrastructure projects, which can present a further risk to the proposal's construction costs and feasibility. Flood mitigation impacts have been considered as part of the proposal's assessment, although the findings will not be available until the EIS is finalised later in 2022.</p>
<b>Sustainability</b>	<p>The proposal still requires approval under the <i>Environmental Planning and Assessment Act 1979</i> (NSW) and the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth). It is also yet to achieve environmentally sustainable development outcomes in line with the Project Secretary's Environmental Assessment Requirements<sup>4</sup>.</p>
<b>Resilience</b>	<p>The proposal's primary objective is to improve water availability and security for the town of Tamworth. The business case states that as the town's population and water demand grows, within two decades Tamworth could be at risk of running out of water 1 in 20 years under a dry climate scenario (assuming no major water management strategy is put in place). As the proposal results in a significant reduction in the incidence of restrictions and risk of water supply shortfall, it is considered to address the resilience need.</p>
<b>Deliverability</b>	<b>The capability to deliver the proposal successfully, with risks being identified and sufficiently mitigated.</b>
<b>Ease of implementation</b>	<p>An alliance contract has been identified as the most suitable delivery and procurement option. This is a complex delivery model and further investigation is required on the role and interface of the multiple stakeholders, as well as definition and ownership of risks.</p>
<b>Capability &amp; capacity</b>	<p>Development and execution of an appropriate implementation plan for the alliance is yet to be determined. A resourcing plan which sets out the timing and duration of key activities is also needed to provide confidence that the proposal can be successfully delivered.</p>
<b>Project governance</b>	<p>The governance arrangements under the alliance model are still under development and are to be finalised in combination with the alliance model itself being finalised.</p>
<b>Risk</b>	<p>The shortlisted options have undergone a Quantitative Risk Analysis process, which included schedule risk analysis, cost risk analysis and contingent risk events. In addition, individual risk workshops were undertaken to ascertain contingent risks.</p> <p>Although there is a risk management plan in place, there is still substantial uncertainty and subjectivity in many aspects of the procurement strategy (i.e. implementation plan, project organisation and resourcing plan, which are currently under development). The lack of an approved EIS is also a key risk which could increase costs.</p>
<b>Lessons learnt</b>	<p>While there is insufficient information to ascertain whether lessons from similar projects have been used to inform analysis during each stage of the proposal's development, previous dam projects in Australia (between 2006-2016) were reviewed for the identification</p>

<sup>4</sup> [https://water.dpie.nsw.gov.au/\\_data/assets/pdf\\_file/0009/386073/Issued-SEARs\\_27072020\\_033308.pdf](https://water.dpie.nsw.gov.au/_data/assets/pdf_file/0009/386073/Issued-SEARs_27072020_033308.pdf)

of a commonly adopted delivery model.

The benefit profiles and change controls for the proposal are in development and a post-implementation evaluation plan is to be prepared as part of the next stage of the proposal's planning (in accordance with the NSW Government Program Evaluation Guidelines).

## Economic appraisal results

The proponent's stated NPV for the preferred option (New Dungowan Dam and Pipeline) is -\$525.1 million, with a BCR of 0.09 using a 7 per cent real discount rate and P50 cost estimates. The key assumptions underpinning the results include:

- Construction (for the main works) in 2023
- Functional operation in 2029 (first benefits to be realised in 2030)
- Evaluation period of 30 years
- Input parameter values inflated to real 2022 dollars
- 100-year life for the dam infrastructure.

The core demand driver is future urban water demand, which relies on input parameters for demographics, specifically population projections and growth rates, and urban water use levels, including at different levels of restrictions. Forward projections of urban water demand have been prepared using a robust process that combines detailed local hydrology with a broad review of relevant literature. Parameter inputs have been informed by contemporary data and information to the extent possible. Key hydrological parameters (forecast frequency, duration and severity of water restrictions and supply shortfalls) under both the base case and shortlisted options have been appropriately incorporated.

The following table presents the economic appraisal results for the three options considered in the business case.

Discount rate:		4%	7% (central)	10%
Dungowan Dam and Pipeline <sup>1</sup>	BCR:	0.20	0.09	0.04
	NPV (\$m):	(\$532.5)	(\$525.1)	(\$480.8)
Keepit Pipeline <sup>1</sup>	BCR:	0.18	0.08	0.03
	NPV (\$m):	(\$335.6)	(\$324.6)	(\$298.0)
Increased Urban Reserve <sup>1</sup>	BCR:	0.77	0.49	0.34
	NPV (\$m):	(\$1.6)	(\$3.3)	(\$4.1)
Key benefits measured:	The quantification of economic benefits in the cost-benefit analysis includes the alleviation of the urban water security risk (i.e. avoided economic cost of water restrictions and supply shortfall) and residual values. The analysis also quantified the disbenefit associated with the diversion of water from irrigators for urban water use under the various scenarios.			
Key observations and issues	<p>There is insufficient evidence that the New Dungowan Dam and Pipeline is the most appropriate response to Tamworth's water security when compared to the Increased Urban Reserve to Chaffey Dam option, which presents significantly better BCR and NPV results.</p> <p>While the demand forecasting method under the base case is appropriate, the demographic projections are similar to those applied under the shortlisted options (under which the water supply risk is addressed). If the risk of water security is expected to have a material impact on future economic activity and liveability in Tamworth, this could be reflected in the base case demographic projections. That is, if population growth and water demand is expected to be lower in the future due to water security risks, then this could be reflected in the forecasts used in the base case. Modelling this approach could provide more evidence of the proposal's benefits and likely increase the BCR.</p>			



The cost-benefit analysis includes quantification of the disbenefit attributable to the reduced reliability of supply for irrigators in the Peel Valley. The benefits of the proposal are derived from reduced water restrictions and shortfalls rather than the value of increased water supply. The new dam will not result in any increased allocation or entitlements.

Due to critical input data being unavailable, the approach used for the calculation of the residual value<sup>5</sup> is not consistent with the preferred approach in NSW Government guidelines. This results in the NPV and BCR of the recommended option being materially overstated, as the residual value is 13 times the Present Value of the water security benefits quantified under this option.

The sensitivity testing detailed in the business case is robust and transparent. However, a more evidence-based approach could have been adopted to identifying the parameter values on which sensitivity analysis on the BCR has been conducted (as opposed to standardised reductions and increases). Extensive and robust analysis of climate variability was considered in the hydrological modelling, although the sensitivity analysis would have benefitted from consideration of climate variability on the results of the BCR and the future water supply-demand balance.

(1) Costs reported in this table are based on P50 expected value cost estimates.

### Quantification of economic benefits and costs

The quantification of the economic benefits of the shortlisted options, while robust, is not consistent with the qualitative assessment included in the problem identification component of the business case.

The residual value calculated for the New Dungowan Dam and Pipeline option is likely to be significantly overstated. The residual value should be the lesser of the present value of future benefits expected to accrue beyond the evaluation period and the replacement cost of the assets at the end of the evaluation period. For the New Dungowan Dam and Pipeline option, only the replacement cost has been considered, with the depreciated capital approach used as a proxy for replacement cost. Using this method, the residual value is estimated to be \$45.5 million (at a discount rate of 7 per cent), which accounts for over 93 per cent of the total economic benefit. The rationale for adopting this approach to calculate the residual value is due to the uncertainty estimating economic benefits beyond the evaluation period. Given the chosen depreciated capital approach results in a value that is more than 13 times the PV of the water security benefits over the evaluation period, this is not considered to be sufficient justification. A traditional approach to calculating the residual value would significantly lower the BCR from the current estimate.

### Sensitivity analysis

The sensitivity analysis is robust and consistent with the minimum requirements set out in the Infrastructure Australia Assessment Framework. However, the high and low estimates used in the sensitivity analysis could have been selected having closer regard for the range of potential values of these parameters, rather than applying arbitrary percentage increases and reductions. Secondly, the feasibility of the shortlisted options could be modelled based on a 'worst case climate change' scenario, based on a review of climate scenarios from reputable climate models. This would provide additional information regarding the impact of changes to key parameters on the economic feasibility of the shortlisted options.

## Proposal development

### Context

The Dungowan Dam proposal involves replacing an existing dam currently owned and operated by Tamworth Regional Council. Tamworth is the largest regional centre in north-west NSW and is a critical service hub for local residents and smaller rural and regional communities throughout the Namoi region. The region has a population of approximately 95,000 and the economy is heavily dependent on agriculture, manufacturing, construction and services industries.

### Problem description

Tamworth has experienced significant periods of high-level water restrictions in recent years, with the threat of the town running out of water projected to increase with the impacts of climate change. The water security risk may also constrain business investment and economic activity in the region.

The magnitude of the service need is demonstrated by the quantification of the economic benefits (being the reduced

<sup>5</sup> Residual value is the value of an asset at the end of the appraisal period..

incidence of water restrictions and risk of a water supply shortfall). These benefits range from \$3.43 million to \$5.76 million (PV terms) over 30 years. It is noted that the quantification of the economic benefits does not include the avoidance of investment and economic activity being foregone as a result of the water security risk.

A generally conservative approach has been adopted to quantification of the implications of not addressing the identified problem under the base case, specifically, the approach to modelling the impact of climate change. Also, as noted in the business case, practical limitations are likely to mean that cartage of water in the event of a supply shortfall is not feasible and an evacuation of Tamworth would likely be required. The economic cost associated with this event would likely far exceed the cost attributed to water cartage (noting the difficulties associated with quantifying this cost).

### Options identification and assessment

The business case notes that 56 infrastructure and non-infrastructure options were identified in the initial long list. Of these options, six were included in a revised long list based on an initial filtering process which considered if each option was sufficient to address the service need. Of the six options included in the revised long list, only two non-infrastructure options were considered – increasing the urban reserve to Chaffey Dam and the conversion of the existing General Security licence entitlements to Local Water Utility (LWU) licence entitlements. While it may be the case that the non-infrastructure options included in the initial long list were not sufficient to address the identified problem on their own, **water security issues can often be sufficiently addressed with a package of solutions that are not mutually exclusive**. A package of non-infrastructure measures should have been explicitly considered as part of the options assessment process, noting that this could address the service need at significantly lower cost relative to the proposed infrastructure solutions. This is a key shortcoming of the options assessment process.

Once the six long list options were defined, a further filtering process was undertaken based on the outcomes of preliminary hydrology modelling to assess the impact of each option on the frequency of restrictions and risk of supply shortfall, and a high-level economic appraisal, taking into account key benefits and the costs attributable to each option.

### Identification of the preferred option

**The selection of the New Dungowan Dam and Pipeline as the recommended option is poorly substantiated.** The option has been recommended on the basis that “the other options do not develop new capacity and therefore focus on shifting the burden of the existing level of service, which is expected to decline, between different stakeholders either within the Peel Valley or Namoi region.” **This is inappropriate, as the problem that has been identified is the need to address Tamworth’s water security risk (i.e. access to water), rather than increasing the storage capacity in the region.** Economic analysis of the three options presented in the business case demonstrates that the water security risk is more efficiently addressed by options that do not involve the development of new capacity. The Increased Urban Reserve option returns a significantly better BCR and NPV result than the other shortlisted options, outperforming the New Dungowan and Pipeline option in terms of the quantified benefit from improved water security (\$3.85 million compared to \$3.43 million).

The recommendation of the preferred option is based primarily on the outcomes of a Strategic Merit Test, which has not been well explained. Specifically, the Increased Urban Reserve option scored poorly in relation to investment decision readiness and stakeholder acceptance. This is not supported by the results of the cost-benefit analysis or other information in the business case. In relation to the risk associated with stakeholder acceptance, the cost-benefit analysis includes quantification of the disbenefit attributable to the reduced reliability of supply for irrigators in the Peel Valley. This disbenefit is quantified at only \$660,000 in PV terms under the Increased Urban Reserve option. This indicates the adverse impact on irrigators is highly likely to be mitigable at low cost.<sup>6</sup> Compensation to non-urban users was not considered in the Increased Urban Reserve option. In addition, the poor performance of this option in terms of investment readiness gives insufficient consideration to the lack of infrastructure required to implement it, whereas the New Dungowan Dam and Pipeline option would not be completed until 2029. Further assessment, including hydrological, economic, and ecological analysis, will provide greater understanding of the feasibility of the Increased Urban Reserve option.

Hence, having regard to the results of the cost-benefit analysis and justification of the assessment of the shortlisted options in the Strategic Merit Test, the identification of the New Dungowan Dam and Pipeline option as the preferred option appears inappropriate. The Increased Urban Reserve option achieves greater benefits at significantly lower economic cost, with limited deliverability risk.

### Deliverability

**We consider the risks to deliverability and implementation of the New Dungowan Dam and Pipeline are understated relative to the other shortlisted options.** A low risk is attributed on the basis that there is a high degree of uncertainty with the alternative infrastructure and non-infrastructure solutions. This conclusion has been reached even though the EIS for

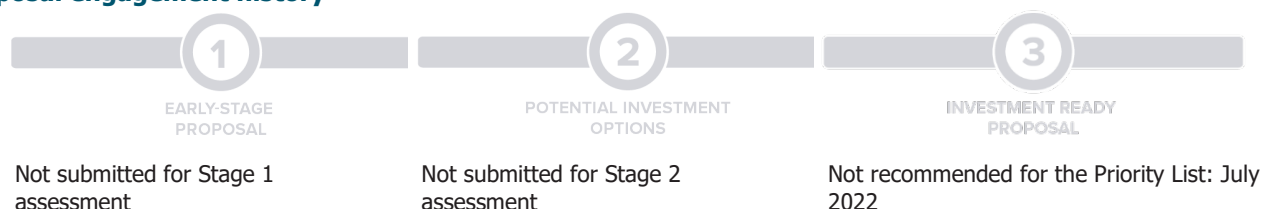
<sup>6</sup> Also noting the impact on irrigators is based on the assumption that all irrigation water is used for lucerne, which is a low-value crop used for fodder for which reliability of water supply is not typically of major concern for producers.

the preferred option is not complete and several required plans and approvals are yet to be obtained.<sup>7</sup> In our view, sufficient information has not been provided to demonstrate that the other shortlisted options, including the Keepit Pipeline and Increased Urban Reserve options, have higher deliverability and implementation risks than the preferred option. The New Dungowan Dam and Pipeline is a far more complex undertaking and has an extensive construction period.

### Consideration of COVID-19

The COVID-19 pandemic represents a significant disruption on infrastructure decisions in Australia. There is no discussion in the business case of the COVID-19 implications on labour and input material demand as well as supply.

### Proposal engagement history



## Detailed economic appraisal results

The following table presents a breakdown of the benefits and costs stated in the business case.

### Benefits and costs breakdown

Proponent's stated benefits and costs	Present value (\$m, 2021/22)			% of total for 7% results
	4%	7%	10%	
<b>Discount rate (real)</b>	<b>4%</b>	<b>7%</b>	<b>10%</b>	
<b>Costs</b>				
Total capital costs (P50)	\$644.9	\$560.0	\$490.5	97.6%
Operating costs	\$24.3	\$13.9	\$8.5	2.4%
<b>Total costs<sup>1,2</sup></b>	<b>\$669.2</b>	<b>\$573.9</b>	<b>\$499.0</b>	<b>100%</b>
<b>Benefits</b>				
Agricultural benefits	(\$0.2)	(\$0.1)	(\$0.1)	0.0%
Urban water security benefits	\$6.5	\$3.4	\$2.0	7.0%
Residual value of asset	\$130.3	\$45.5	\$16.4	93.0%
<b>Total benefits<sup>1</sup></b>	<b>\$136.6</b>	<b>\$48.8</b>	<b>\$18.2</b>	<b>100%</b>
<b>Net present value (NPV)<sup>3</sup></b>	<b>(\$532.5)</b>	<b>(\$525.1)</b>	<b>(\$480.8)</b>	<b>n/a</b>
<b>Benefit-cost ratio (BCR)<sup>4</sup></b>	<b>0.20</b>	<b>0.09</b>	<b>0.04</b>	<b>n/a</b>

Source: Proponent's business case

(1) Totals may not sum due to rounding.

(2) Costs reported in this table are based on P50 expected value cost estimates.

(3) The net present value is calculated as the present value of total benefits less the present value of total costs.

(4) The benefit-cost ratio is calculated as the present value of total benefits divided by the present value of total costs.

<sup>7</sup> Including the Review of Environmental Factors; the Aboriginal Engagement and Participation Plan; approval under the Environmental Planning and Assessment Act 1979, and the Environment Protection and Biodiversity Conservation Act 1999.